Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA)
Available online at www.inia.es/sjar

Spanish Journal of Agricultural Research 2008 6(3), 408-411
ISSN: 1695-971-X

# Short communication. Survey for incidence of *Okra mosaic virus* in northern Nigeria and evidence for its transmission by beetles

M. Alegbejo, M. Ogunlana and O. Banwo*

*Department of Crop Protection. Institute for Agricultural Research (IAR). Faculty of Agriculture. Ahmadu Bello University (ABU). Zaria. Nigeria*

## Abstract

A two year survey was conducted in 2003 and 2004 in okra (*Abelmoschus esculentus*) plants for *Okra mosaic virus* (OkMV; genus *Tymovirus*) symptoms at three locations in northern Nigeria. It showed that the highest incidence of OkMV occurred at Samaru (16.50 and 17.10% in 2003 and 2004, respectively), followed by Shika (13.02 and 14.82%) and Bomo (12.31 and 8.10%). Disease severity followed the same trend. Beetles of *Podagrica* spp. naturally infected were efficient vectors in the transmission of OkMV.

**Additional key words**: Africa, gel diffusion test, plant virus.

## Resumen

**Comunicación corta. Incidencia del virus del mosaico del kimbombó en el norte de Nigeria y evidencias de su transmisión por escarabajos**

En 2003 y 2004 se llevó a cabo una prospección de síntomas del virus del mosaico del kimbombó (OkMV, género *Tymovirus*) en plantas de kimbombó (*Abelmoschus esculentus*) en tres localidades del norte de Nigeria. La incidencia de OkMV más alta se detectó en Samaru (16,50 y 17,10% en 2003 y 2004, respectivamente), seguido de Shika (13,02 y 14,82%) y Bomo (12,31 y 8,10%). En las tres localidades la severidad de la enfermedad siguió la misma tendencia. Escarabajos de *Podagrica* spp. naturalmente infectados fueron vectores eficientes en la transmisión de OkMV.

**Palabras clave adicionales**: África, test de diffusion en gel, virus vegetales.

Okra (*Abelmoschus esculentus* (L.) Moench, botanical synonym *Hibiscus esculentus* L.) is an important vegetable crop and is now widely cultivated in different parts of the world. It is used industrially as a fibre and for food as a vegetable. Gum, starch, spice and medicinal products can be obtained from it. *Okra mosaic virus* (OkMV; genus *Tymovirus*) causes one of the most important diseases of the crop (Lana *et al*., 1974; Odebunmi-Oshikanlu, 1977; Igwegbe, 1983; Atiri, 1984; Alegbejo, 1997, 2001a, 2003). It elicits mosaic and yellowing symptoms interspersed with green islands on okra leaves and infected fruits develop chlorotic flecks (Givord and Hirth, 1973; Koenig and Givord, 1974; Lana, 1974; Alegbejo, 2001a). A yield loss of 10 to 80% is caused by the virus (Alegbejo, 2001b) and loss incidence may reach 100% before harvest (Atiri, 1984). In Tanzania, OkMV incidence of 30 to 89% has been reported (Nduguru and Rajabu, 2004). The virus is not seed transmitted (Koenig and Givord, 1974), but it is mainly transmitted by the beetles of *Podagrica* spp. (Lana and Taylor, 1975; Atiri, 1984, 1990; Alegbejo, 2001a,b). This research aimed at determining the incidence of OkMV-caused disease in northern Nigeria, an important okra producing region.

Okra plants of 'White Velvet' the most common variety of okra grown in these areas, with OkMV symptoms were surveyed at Samaru (latitude 11° 11' N, longitude 07° 38' E, altitude 686 m), Bomo village and Shika in the wet seasons (August) of 2003 and 2004. Four farms were surveyed at each location (a total of 12 farms), and four quadrats of 4 × 4 m were randomly selected on each farm. The number of plants with OkMV symptoms and the total number of plants in each quadrat was recorded. Plants with symptoms were summed and the percentage of infected plants in each field and at each location calculated. Plant disease severity for each plant was scored using a 1-5 scale

* Corresponding author: banleks@yahoo.co.uk
Received: 18-07-07; Accepted: 26-05-08.

(where 1 = no visible symptoms; 3 = mild mosaic but no leaf distortion; 5 = severe mosaic and leaf curling). Farm size was estimated and recorded as well as the crop growth stage and the type of crop mixture. The standard error of difference (SED) was used to separate means that differed at the 5% level of probability.

Three types of tests were conducted:

— Serological tests using the gel diffusion technique (Noordam, 1973) with sap taken from okra plants showing OkMV symptoms and a control (non-infected okra plant). The antiserum to OkMV used was supplied by Dr. D. B. Dangora, Department of Biological Science, Ahmadu Bello University, Zaria.

— Infectivity tests to determine if the vectors were naturally infective.

— Transmission tests to determine the efficiency of the vector.

For the infectivity test, 'White Velvet' okra plants, grown in small cage-like containers, were taken out to the field. Live *Podagrica* spp. beetles were collected from OkMV-infected okra plants and were immediately placed onto the okra seedlings. One insect was placed on each okra plant; there were 10 test plants and 10 control plants (with no insect) for each of the three experimental replicates. Plants with insects were taken to a screen house and kept for 3 days of inoculation access feeding. After this, insects were removed and plants, including the controls, were tested for the presence of OkMV.

To test vector efficiency, transmission studies were carried out in a screen house using White Velvet okra plants. The vectors (*Podagrica* spp.) were collected with aspirators and sweep nets from okra fields in which 'White Velvet' was being grown. During transportation from the field, the beetles were kept in closed bottles with a perforated cover. An electronically operated aspirator and a camel hair brush were used to collect and transfer insects from plant to plant and from cage to plant. The insects were kept in wooden cages, measuring $70 \times 80 \times 70$ cm, before being used for transmission tests. Acquisition feeding by adult beetles lasted 3 days on caged okra plants. There was one insect on each infected plant. For the transmission test (inoculation feeding), two to three leaf seedlings stage were used. This was because okra plants are highly preferred by the vectors at this stage (consequently making them very susceptible to OkMV). Tubes measuring 3.0 cm and covered with netting, retained the insects on the plants for the transmission test. Ten potted plants were used in each experiment. The treatments consisted of different numbers of adult beetle vectors (viz, 0, 1, 2, 3 and 4). There were five replicates arranged in a randomized complete block design. Plants with no insect (0), were the control. Plants exposed to insects were kept in a screen house for 3 weeks for symptom observations. To verify the presence or absence of OkMV, plants were evaluated, as in the other experiments, using the gel diffusion technique (Noordam, 1973). The transmission percentage for the treatments (vector numbers) was calculated on the basis of the presence or absence of OkMV in each of the 10 plants in each replicate.

Results of the two year survey (Tables 1 and 2) indicate that the highest incidence of OkMV occurred at Samaru, followed by Shika and Bomo. Disease severity

**Table 1.** Incidence of *Okra mosaic virus* in the Samaru, Bomo and Shika areas of northern NIgeria in 2003 and 2004

| Location | Number of farms visited | | OkMV-infected plants (%) | | Crop growth stage | Type and number of crop mixtures | Average farm size (ha) | | Disease severity (1-5) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2003 | 2004 | 2003-2004 | 2003-2004 | 2003 | 2004 | 2003 | 2004 |
| Samaru | 4 | 4 | 16.5 | 17.1 | Flowering or fruiting | Sole okra (4)* | 0.10 | 0.10 | 3.50 | 3.60 |
| Bomo | 4 | 4 | 12.3 | 8.1 | Flowering or fruiting | Sole okra (2) okra/pepper (1) okra/tomato (1) | 0.32 | 0.33 | 3.20 | 3.25 |
| Shika | 4 | 4 | 13.0 | 14.8 | Flowering or fruiting | Sole okra (1) okra/pepper (2) okra/tomato (1) | 0.45 | 0.50 | 3.01 | 3.31 |
| SED (P = 0.05) | | | 3.5 | 4.1 | | | 0.23 | 0.24 | 0.42 | 0.45 |

* Numbers in parenthesis indicate the number of farms with the associated crop pattern. SED: standar error of difference.

**Table 2.** Transmission of *Okra mosaic virus* by naturally infected *Podagrica* spp.

| Experiment number | Number of plants infected out of 10 | |
|---|---|---|
| | Control | *Podagrica* spp. |
| 1 | 0 | 6 |
| 2 | 0 | 4 |
| 3 | 0 | 5 |
| Mean infection | 0% | 50% |

followed the same trend (Table 1). The average size of farms visited was 0.1 to 0.45 ha in 2003, and 0.1 to 0.5 ha in 2004. Beetles (*Podagrica* spp.), which were found in large numbers, were associated with the disease, as shown by the results of the infectivity test (Table 2) and the efficiency of the vector in transmitting OkMV (Table 3). All Samaru fields were sole cropped while those of Bomo and Shika were either sole cropped or mixed with pepper (*Capsicum annum* L.) or tomato (*Solanum lycopersicon* L.) (Table 1).

The results showed that okra mosaic disease, caused by OkMV, is ubiquitous in northern Nigeria as it was detected in every field where the surveys were conducted. A disease with similar symptoms was described by Givord and Koenig (1974), Lana *et al*. (1974) and Atiri (1984) in the south west of Nigeria. Isolates of OkMV from Ivory Coast and Nigeria are considered to be related, but distinct, strains (Givord and Hirth, 1973; Bozarth *et al.,* 1977; Alegbejo, 2001a,b). The experimental fields had a higher disease incidence than the farmers fields, therefore okra landraces could be screened for disease resistance. Resistance genes could then be incorporated into okra cultivars with desirable characteristics.

Finally, the endemic nature of okra mosaic disease in northern Nigeria may be due to weeds such as *Urena lobata*, *Physalis angulata* and *Sida acuta,* hosting the virus, which were present in and around okra fields (Atiri, 1984; Alegbejo, 2001a) and may be an important source of OkMV. Efforts will be made to develop environmentally friendly control measures to contain the menace caused by this disease.

**Table 3.** Efficiency of *Podagrica* spp. in transmission of *okra mosaic virus*

| Number of insects | Infected plants (%) |
|---|---|
| 0 (control) | 0 |
| 1 | 21 |
| 2 | 30 |
| 3 | 41 |
| 4 | 42 |

## Acknowledgements

We appreciate funds provided by the Horticultural Crops Research Programme, Institute for Agricultural Research Ahmadu Bello University Zaria, for the conduct of the survey.

## References

ALEGBEJO M.D., 1997. Evaluation of okra genotypes for resistance to okra mosaic virus. Proc 15th Annual Conference of HORTSON held at NIHORT, Ibadan, Nigeria, 8-11 April. p. 60.

ALEGBEJO M.D., 2001a. Effect of sowing date on the incidence and severity of Okra mosaic Tymovirus. J Veg Crop Prod 8, 9-14.

ALEGBEJO M.D., 2001b. Reaction of okra cultivars screened for resistance to okra mosaic virus in Samaru, Northern Guinea Savanna, Nigeria. J Sust Agr Env 3, 315-320.

ALEGBEJO M.D., 2003. Okra cultivars with moderate resistance to *Okra mosaic virus* genus *Tymovirus*. Nig J Hort Sci 5, 3-8.

ATIRI G.I., 1984. The occurrence of okra mosaic virus in Nigerian weeds. Ann Appl Biol 104, 261-265.

ATIRI G.I., 1990. Relationship between growth stages, leaf curl development and fruit yield in okra. Sci Hort 54, 49-53.

BOZARTH R.F., LANA A.O., KOENIG R., REESE J., 1977. Properties of the Nigerian and Ivory Coast strains of Okra mosaic virus. Phytopathology 67, 735-737.

GIVORD L., HIRTH I., 1973. Identification, purification and some properties of a mosaic of okra (*Hibiscus esculentus* L). Ann Appl Biol 74, 359-370.

GIVORD L., KOENIG R., 1974. Okra mosaic virus. Commonwealth Mycological Institute/Annals of Applied Biologists Description of Plant Viruses 128, 4 pp.

IGWEGBE E.C.K., 1983. New strain of okra mosaic in Nigeria. Plant Dis 67, 320-322.

KOENIG R., GIVORD L., 1974. Serological interrelationships in the turnip yellow mosaic virus group. Virology 58, 119.

LANA A.F., 1974. Mosaic virus and leaf curl disease of okra in Nigeria. PANS 4, 474-478.

LANA A.O., TAYLOR T.A., 1975. The insect transmission of an isolate of okra mosaic virus occurring in Nigeria. Ann Appl Biol 82, 361-364.

LANA A.O., GILMER R.M., CHEDA H.R., FATOKUN D.O., 1974. A virus induced mosaic of okra (*Hibiscus esculentus* L.) in Nigeria. Plant Dis Rep 58, 616-619.

NDUGURU J., RAJABU A.C., 2004. Effect of okra mosaic virus disease on the above ground morphological yield component of okra in Tanzania. Sci Hort 99, 225-235.

NOORDAM D., 1973. Identification of plant viruses: methods and experiments. Centre for Agricultural Publishing and Documentation, Wageningen, The Netherlands. 206 pp.

ODEBUNMI-OSHIKANLU Y.O.K., 1977. More important diseases of selected local vegetables in Nigeria. Nig J Plant Prot 3, 79-83.